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5 January 1955

MEMORANDUM FOR: Acting Chief, CPA

SUBJECT: Technical Information on Burial Materials

REFERENCE: Memorandum from Acting Chief, CPA, to TSS/MD, [redacted] dated 13 September 1954 25X1

1. By referenced memorandum, TSS/MD has been asked to provide the office of Training with information on the capabilities of the following burial materials:

a) Stainless Steel Burial Container

b) Nylon Back Barrier Material

c) Hot Dip Plastic

2. The discussion of these items is centered about these factors:

1. Amount of moisture vapor transmission

2. Expected life

3. Best usage

4. Characteristic of material

5. Information as to positive tests that have been run (Agency or Service)

6. Degree of sterility for each material (Agency and U. S. - Allied)

3. It is hoped that the following report contains the necessary information.

[redacted] 25X1

DD/P/TSS/MD [redacted] Chief Mechanical Division, TSS 25X1

Attachment:
Report

008632

DOC 0451 REV DATE 26 JUNE 80 BY 057447
ORIG COMP 052 OPI 52 TYPE 02
ORIG CLASS S PAGES 10 REV CLASS C
JUST 22 NEXT REV 2010 AUTH: HR 70-2

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AMOUNT OF MOISTURE VAPOR TRANSMISSION

a) Stainless Steel Container: Zero of transmission. The only place of possible penetration is around the rubber gasket forming the seal between the container and the hinged cover. Our tests to date, while incomplete, indicate that the seal is moisture vapor resistant and remains so indefinitely. The box can be reopened and closed without seriously reducing the effectiveness of the seal.

b) Nylon Back Barrier Material: Tests on this item show the rate of transmission is so low as to make accurate measurement impossible. For all practical purposes, it is zero.

c) Hot Dip Plastics: The transmission rate is high compared to the other two items. This material has been tested at the 25X1 and found to have a M.V.T. rate of 7 gms./24hrs./mm^2/cm thickness/cm Hg pressure differential at 25°C. Similar tests at the National Bureau of Standards give values of 4.5 to 6.5 measured in the same units. The permeability to gases is likewise high. However, these figures are misleading because the material is used in thick coatings in close contact to solid surfaces wherever possible. Also, oil exudes from the plastic and forms a film on the coated article and aids in preventing rust formation.

EXPECTED LIFE

a) Stainless Steel Container: By virtue of the material used in its construction, the expected life for this item is at minimum five years and possibly much longer. Some tests have been run and others are now in progress. It is expected that the box will continue to provide protection for its contents

for many years under the most adverse soil and water conditions. The weakest point is the gasket forming the hermetic seal.

b) Nylon Back Barrier Material: The useful life of this material is dependent on the physical environment in which it is placed. Prolonged tests are currently being made on the nylon material. Former short-range tests show that its expected life is measured in years rather than months. In one test, articles wrapped in this material were submerged in two feet of water at room temperature for nearly five months and were perfectly preserved. The best estimated expected life is a minimum of two years.

c) Hot Dip Plastics: The life of this material is also measured in terms of years rather than months. Details of a recent test conducted by Ordnance at the Aberdeen Proving Ground are given under the "Positive Tests" section of this report. Type II plastic compound provided protection during an outdoor weathering test for 540 days. This material should provide adequate protection during burial for a minimum of two years.

BEST USAGE

a) Stainless Steel Container: This is the best item available from the standpoint of offering protection for cached articles under adverse conditions for long periods of time. The container is 7 by 9 by 16 1/2 inches and weighs 8 pounds. It will cost approximately $35 in small quantities. In the field, it has the advantage that it can be loaded and sealed in very short time, and no additional sealing apparatus or facilities are required.

b) Nylon Back Barrier Material: This ranks second to the stainless

steel container in the protection it affords. The barrier material costs $4.50 per linear yard and comes in rolls one yard wide. A heat sealing iron designed for closing heat-sealable barrier material is required to seal the material. The sealing temperature is 450°F with a dwell time of eleven seconds. Articles which cannot be hot dipped because of their configuration or heat sensitivity can be packaged in the nylon backed barrier material.

c) Hot Dip Plastics: While ranked below the other two items, hot dip compounds should not be treated as being inferior. These plastic coatings have been used for many years and are proven items. Perhaps the biggest drawback in field use is that special dipping tanks are required. Hot dip tanks are commercially available from a number of supplies both in America and abroad. It can be seen that this method does not readily lend itself to on-the-spot caching as does the stainless steel container.

CHARACTERISTICS OF MATERIAL

a) Stainless Steel Container: The weight, cost and ease of sealing are characteristics which have already been mentioned. The steel is 22 gauge 316 stainless, providing excellent resistance against rust and corrosion. Inside dimensions are 7 x 9 x 16 1/2 inches. All seams are heli-arc welded. The gasket is made of rubber. No handles are presently provided for carrying but will probably be in the future. The box is painted with a special corrosive - resistant paint.

b) Nylon Back Barrier Material: This material is easy to use except that a heat seal is required as noted previously. It is the best flexible barrier material available for caching. Over long periods it has been noted

that delamination of the outer layer occurs. This does not seem to reduce its effectiveness as a waterproof barrier directly, but it undoubtedly reduces its strength and thus makes penetration by water through rips and tears more likely. It is believed that future productions of this material will eliminate this difficulty. The material is fabricated of five separate plys as follows:

PLY NUMBER	MATERIAL
1	.001 inch thick viriyl film
2 and 4	.00045 " " aluminum foil
3 and 5	2.5 ounce minimum per square yard plain weave nylon.

It has these strength properties:

Breaking Strength (Warp & Fill Direction), lbs.	150
Tearing Strength (" " " "), "	25
Weight, Ounces Per Square Yard	2.5

As stated in the manufacturing specifications (MIL-B-13238 Ord), the barrier material shall not lose more than 20% of its strength properties when wet.

c) Hot Dip Plastics: This material is cellulose acetate butyrate. Because of its widespread and comparatively long use, this material and facilities for its use are readily available in most parts of the world. Many types of hot dip compounds are manufactured by different firms. Non-uniformity from batch to batch is sometimes experienced. Each procurement should be checked to make sure it meets the MIL specification JAN-C-149, Type II.

Hot dip coatings provide good corrosion and impact resistance. After a long time it may tend to chip rather than peel. Usually it can be easily removed from the article it covers by peeling it off like the skin from a

tangerine.

It is not advisable to hot dip items which have small holes or crevices. The plastic may not form about these crevices and thus will not lie firmly against the article. It may be difficult or impossible to strip the plastic from any holes in the article. Such articles may be wrapped in aluminum foil or muslin bags and then hot dipped.

Hot dip is unsuited for anything which would be damaged or which is unsafe when raised to a high temperature. Tests are now being planned to check the feasibility of dipping explosives and incendiaries.

The required thickness of the plastic coating is from .050 to .100 inch. Hot dip resists heat at 125°F with a minimum of gumminess and cold at -5°F without any apparent after effect. Type II compound is superior to Type I and is recommended in all cases.

POSITIVE TESTS THAT HAVE BEEN RUN
(Agency and Service)

a) Stainless Steel Container: The tests performed to date on this item consist mostly of inspection and acceptance tests during production plus water submergence tests for leakage. An extensive long range testing program is now in progress. Boxes have been cached under a wide variety of soil and water conditions. The first results from this program will be forthcoming within a half year. In addition, these containers have been in operational use for about six months, but as yet, no reports have been received.

The manufacturing specification for the stainless steel container call for the following tests before the box is considered acceptable:

Each box must withstand without leakage an internal air pressure of five pounds per square inch for a period of two-three minutes when completely submerged in water and held below the surface at a depth of at least six inches. The gasket must have the proper compression of 30 per cent. The box must withstand a static load of 400 pounds on its maximum area. The hasp is tested by slowly applying to it an upward force of 500 pounds for a period of one minute with the box resting on its bottom and the cover fully open. The gasket is tested to see that it remains sung and does not stick at 165°F for a period of 24 hours. Welding coupons are made to see that a 1/2 inch section taken across the seam of the weld can withstand a load of 1,000 pounds dead load without separation of the welded joint.

b) Nylon Back Barrier Material: As with the stainless steel box, the most extensive testing of this item was begun a few months ago and is currently in progress. Articles packed in nylon have been cached under a wide variety of soil and water conditions. Initial results from this program will be forthcoming within six months.

A test at an Agency installation has been cited in this report where items wrapped in the nylon material and submerged in two feet of water at room temperature for nearly five months were perfectly preserved. Some delamination of the outer layer occurred but did not affect the protection provided by the material.

Another test was conducted at a different installation during which nylon back barrier material was subjected to both fungi and climatic tests. The climatic test was subdivided into fungus infested soil, tropical burial, cyclic burial (-30°F to + 130°F), and water immersion. No trouble was experienced from fungus attacks. Of five items enclosed in nylon back barrier material and given cyclic burial, one failed at the seam. The two units subjected to the immersion test failed. These failures were caused by improper sealing due to a

shortage of material and were not termed failures of the material. These tests were run in the latter part of 1953 and lasted six weeks.

c) Hot Dip Plastics: Many tests have been run on this long-established item, both by the Agency and by the military and commercial firms. This item is also included in the current long-range test program. Hot dipped items were included in the two tests mentioned above. In the five-month submergence test, all items were perfectly protected. Upon stripping, it was seen that the articles were covered with a thin oil film from the plastic.

In the other tests (fungi and cyclic burial), these units tested all gave adequate protection. The fungi test did show that the Type II, cellulose-acetate butyrate, provided more resistance than the Type I, ethyl cellulose.

Tests on hot dip began in June 1950 at the Aberdeen Proving Ground and are to run for an indefinite period. Pieces of metal were dipped in Types I and II hot dip compounds meeting military specification JAN-C-149 and were left exposed to weather. The following is from an Ordnance report on these tests:

> "Type I failed to protect and strip properly after sixty days outdoor exposure and failed in twenty-four hours in an accelerated Weatherometer test.
>
> "Type II failed to protect after 540 days outdoor exposure and failed in the Weatherometer after 1,030 hours. It was placed in an oxygen bomb for seventy-two hours at 160°F and 100 pounds pressure. Those formulations which exhibited poor outdoor weathering failed within 106 hours in a humidity cabinet after being subjected to the oxygen bomb. Those exhibiting good outdoor weathering failed within 230 hours. A combination of the oxygen bomb and humidity cabinet shows promise of being a suitable accelerated test for evaluating the outdoor exposure performance of strippable compound."

SOURCE OF STERILITY

a) Stainless Steel Container: The box bears no markings. Type 316 stainless steel is used, and a chemical analysis of the box would probably not even reveal in what country the steel was made. Although the Army does not use a box like this one, its hardware is similar to that of Army containers from which it was adapted. There is nothing about the box to identify it with the Agency.

b) Nylon Back Barrier Material: There are no identifying markings on the material. It would probably be attributed to American manufacture. There is nothing about it to connect it with the Agency.

c) Hot Dip Compounds: Its long and widespread usage makes this product advantageous from a sterility viewpoint. It has been used by the military for over ten years. It is used commercially, not only in this country but also abroad, especially in European countries such as Germany. There is no reason for its being attributed to the Agency.

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13 September 1954

MEMORANDUM FOR: [redacted] R & D Section, TSS 25X1

SUBJECT: Technical Information

1. It is requested that TSS furnish the Office of Training the technical information on the capabilities of the hot dip plastic and nylon foil barrier materials and the stainless steel containers from the following points:

a. Amount of M.V.T.
b. Length of expected life
c. Best usage
d. Characteristic of material
e. Information as to positive tests that have been run (Agency or Service)
f. What degree of sterility for each material (Agency and U. S. - Allied)

2. The above information is to be used in training and in compiling information for a booklet on caching and caching material. Any other information that would be pertinent to this subject should be included if possible.

Bill 31215

acknowledged by attached memorandum and report, dated 5 pp. 55.

[redacted] 25X1

Acting Chief, CFA

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